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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/802,586	03/17/2004	Joel David Munter	MP1502	5149
64768 7590 10/15/2008 MARSHALL, GERSTEIN & BORUN, LLP (MARVELL) 233 SOUTH WACKER DRIVE 6300 SEARS TOWER CHICAGO, IL 60606-6357				
EXAMINER WANG, BEN C				
ART UNIT 2192		PAPER NUMBER		
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/802,586

Applicant(s)

MUNTER ET AL.

Examiner

BEN C. WANG

Art Unit

2192

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 June 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11, 13-18, 20-26 and 28-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11, 13-18, 20-26 and 28-33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/808)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

1. Applicant's amendment dated June 18, 2008, responding to the Office Action mailed March 18, 2008 provided in the rejection of claims 1-41, wherein claims 11, 18, and 26 have been amended, claims 12, 19, and 27 were canceled, and claims 31-33 are new.

Claims 1-11, 13-18, 20-26, and 28-33 remain pending in the application and which have been fully considered by the examiner.

It is noticed that the claims 28-30 are omitted as pending claims (recited on P. 11, first paragraph in the REMARKS).

Applicant's arguments with respect to claims currently amended have been fully considered but are moot in view of the new grounds of rejection – see *Renouf et al.* - art made of record, as applied hereto.

Claim Rejections – 35 USC § 103(a)

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-11, 13-18, 20-26, and 28-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chauvel et al. (Pub. No. US 2004/0010785 A1) (hereinafter

'Chauvel') in view of Renouf et al. (Pub. No. US 2004/0015914 A1) (hereinafter 'Renouf' - art made of record)

3. **As to claim 1** (Previously Presented), Chauvel discloses a method comprising:

- receiving a plurality of non-native instructions (e.g., [0008] - the JVM executes the byte-codes just as a processor executes machine code; however, the byte-codes do not directly control the underlying hardware; instead, they are interpreted by the JVM) in a selected one of a source form and an intermediate form (e.g., [0008] – JAVA™ programs [source form] are compiled into "byte-codes" [an intermediate form])

Further, Chauvel discloses the profiling techniques described herein could be adapted to take into account an interpreter-based execution and a JIT one (e.g., [0063]) and to acquire a virtual machine profile that relates power consumption to individual operations (e.g., Page 7, Left-Col., Lines 32-35), but does not explicitly disclose compiling the plurality of non-native instructions to generate object code for the non-native instructions, wherein compiling the plurality of non-native instructions includes replacing an object code segment from the generated object code with an alternative object code segment if the alternative object code segment improves at least a selected one of a power level required and an amount of energy required to execute the generated object code in a target execution environment.

However, in an analogous art of *Loading Object-Oriented Computer Program*, Renouf discloses compiling the plurality of non-native instructions to generate object code for the non-native instructions (e.g., Fig. 2, elements 213 – Virtual Processor Byte

Code; 214 – Native Translator; 230 – Native Code; [0068] - ... converted by the native translator 214 to the native code 230; [0123] - The native translator 214 is quite a small piece of code, so that it can easily be stored in memory within an embedded system ...), wherein compiling the plurality of non-native instructions includes replacing an object code segment from the generated object code with an alternative object code segment (e.g., [0123] - ... On binding (or sometimes at run-time) the fix-up code will be replaced with appropriate machine-dependent instructions ... converted to an atom in the native code) if the alternative object code segment improves at least a selected one of a power level required and an amount of energy required to execute the generated object code in a target execution environment (e.g., Fig. 4; [0072] - ... The VP tools are then translated by the individual client translators 424, 425 into native methods 483, 484 which are optimized for their respective processors ...; NOTE: Chauvel discloses a profiling system indicating the time/energy consumed by each operation on a particular hardware platform (e.g., Abstract))

Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made to combine the teachings of Renouf into the Chauvel's system to further provide compiling the plurality of non-native instructions to generate object code for the non-native instructions, wherein compiling the plurality of non-native instructions includes replacing an object code segment from the generated object code with an alternative object code segment if the alternative object code segment improves at least a selected one of a power level required and an amount of energy required to

execute the generated object code in a target execution environment in the Chauvel's system.

The motivation is that it would further enhance the Chauvel's system by taking, advancing and/or incorporating the Renouf's system which offers significant advantages when applied to wireless client networks, each individual transmission is of a significantly shorter duration than with conventional systems in which the entire class file has to be downloaded as once suggested by Renouf (e.g., [0042])

4. **As to claim 2** (Original) (incorporating the rejection in claim 1), Chauvel discloses the method wherein said receiving comprises receiving the non-native instructions in a byte code form (e.g., [0024], Lines 3-7 – the application profile is a byte-code based profile which indicates how many times each operation (such as a byte-code) is used during execution of the application, or in specified parts of the application)

5. **As to claim 3** (Previously Presented) (incorporating the rejection in claim 1), Chauvel discloses compiling comprises analyzing the object code segment for execution power level requirement, and determining whether an alternative object code segment with lower execution power level requirement is available (e.g., Abstract – creating application profiles that indicate the number of execution of each operation in the application and virtual machine profiles which indicate the time/energy consumed by each operation on a particular hardware platform; an application profile in conjunction with the virtual machine profile can be used to generate time and/or energy estimates

for the application; [0062] – to adapt the JVM profile in order to obtain energy consumption estimations of a JAVA™ application; instead of (or in addition to) profiling the execution time on the target, the estimation of energy consumption could be performed using the same principle as for execution; the energy performance (and execution time performance) could be used by the target device for scheduling applications; [0066], Lines 32-35 – acquiring a virtual machine profile that relates power consumption to individual operations; [0010] – to optimize an application, estimations of execution time or energy consumption are often needed; this is particular true in the case of mobile devices, such as smart phones, personal digital assistants, and the like, which have limit energy and processing resources)

6. **As to claim 4** (Previously Presented) (incorporating the rejection in claim 1), Chauvel discloses compiling comprises analyzing the object code segment for execution energy consumption, and determining whether an alternative object code segment with lower execution energy consumption is available (e.g., Abstract – creating application profiles that indicate the number of execution of each operation in the application and virtual machine profiles which indicate the time/energy consumed by each operation on a particular hardware platform; an application profile in conjunction with the virtual machine profile can be used to generate time and/or energy estimates for the application; [0062] – to adapt the JVM profile in order to obtain energy consumption estimations of a JAVA™ application; instead of (or in addition to) profiling the execution time on the target, the estimation of energy consumption could be

performed using the same principle as for execution; the energy performance (and execution time performance) could be used by the target device for scheduling applications; [0066], Lines 32-35 – acquiring a virtual machine profile that relates power consumption to individual operations; [0010] – to optimize an application, estimations of execution time or energy consumption are often needed; this is particular true in the case of mobile devices, such as smart phones, personal digital assistants, and the like, which have limit energy and processing resources)

7. **As to claim 5** (Previously Presented) (incorporating the rejection in claim 1), Chauvel discloses the method wherein

- the method further comprises executing the non-native instructions for an initial number of times using an interpreter (e.g., [0012] – performance for a specified portion of an application, where the specified portion can include all or part of the application, the executes on a target device via a virtual machine interface is estimated by acquiring an application profile that specifies a number of executions for a plurality of operations used in the specified portion of the application, acquiring a virtual machine profile that relates a performance characteristic to individual operations and generating an aggregate value for the performance characteristic based on the application profile and the virtual machine profile; [0013]; [0036] – to calculate the application profile, the application is executed with a JVM, which is instrumented to count each

operation and calculate the profile. The JVM which is used to generate the profile is referred to as the 'profiling tool'); and

- performing said compiling only after executing the non-native instructions for said initial number of times (e.g., [0013] - ... By independently generating the application profile, based on the number of times operations are executed in the application ...; NOTE: Renouf discloses a native translator (e.g., Fig. 2, element 214 – Native Translator))

8. **As to claim 6** (Previously Presented) (incorporating the rejection in claim 5), Chauvel discloses the method wherein the method further comprises determining the initial number of times the received non-native instructions are to be executed using the interpreter before performing compiling the received non-native instructions (e.g., .., [0013] - ... By independently generating the application profile, based on the number of times operations are executed in the application ...; NOTE: Renouf discloses a native translator (e.g., Fig. 2, element 214 – Native Translator))

9. **As to claim 7** (Previously Presented) (incorporating the rejection in claim 6), Chauvel discloses the method wherein the method further comprises

- monitoring said compiling for power level required to perform compilation (e.g., [0012] – performance for a specified portion of an application, where the specified portion can include all or part of the application, the executes on a target device via a virtual machine interface is estimated by acquiring an

application profile that specifies a number of executions for a plurality of operations used in the specified portion of the application, acquiring a virtual machine profile that relates a performance characteristic to individual operations and generating an aggregate value for the performance characteristic based on the application profile and the virtual machine profile; [0013]);

- updating a current understanding of power level required for compilation and determining the initial number of times received non-native instructions are to be executed using the interpreter (e.g., [0036] – to calculate the application profile, the application is executed with a JVM, which is instrumented to count each operation and calculate the profile. The JVM which is used to generate the profile is referred to as the 'profiling tool') before compiling the received non-native instructions (e.g., [0012] – performance for a specified portion of an application, where the specified portion can include all or part of the application, the executes on a target device via a virtual machine interface is estimated by acquiring an application profile that specifies a number of executions for a plurality of operations used in the specified portion of the application, acquiring a virtual machine profile that relates a performance characteristic to individual operations and generating an aggregate value for the performance characteristic based on the application profile and the virtual machine profile; [0013]), if said monitoring observes a power level required for compilation to be different from the current understanding (e.g., Fig. 2 – a state diagram describing the generation of an application profile; [0029] – the execution of each operation in the application

increments a counter associated with the particular operation.; each executed operation is counted until an off command is received; a save results command causes the values of the counters to be stored in file; Fig. 3a – a state diagram describing the generation timing information for a virtual machine profile; Fig. 3b – a state diagram describing the generation energy information for a virtual machine profile; [0045] – the energy consumption data could be based on resources used by the operation and the time of execution; maximum and minimum execution times associated with the operation are maintained as well; upon receiving the save results command, the average energy consumption is calculated for each operation and is stored in the JVM profile)

10. **As to claim 8** (Previously Presented) (incorporating the rejection in claim 6), Chauvel discloses the method wherein the method further comprises

- monitoring said compiling for amount of energy required to perform an average compilation (e.g., [0012] – performance for a specified portion of an application, where the specified portion can include all or part of the application, the executes on a target device via a virtual machine interface is estimated by acquiring an application profile that specifies a number of executions for a plurality of operations used in the specified portion of the application, acquiring a virtual machine profile that relates a performance characteristic to individual operations and generating an aggregate value for the performance characteristic based on the application profile and the virtual machine profile; [0013]);

- updating a current understanding of amount of energy required for an average compilation; and determining initial number of times received non-native instructions are to be executed using the interpreter (e.g., [0036] – to calculate the application profile, the application is executed with a JVM, which is instrumented to count each operation and calculate the profile. The JVM which is used to generate the profile is referred to as the 'profiling tool') before compiling the received non-native instructions, if said monitoring observes an amount of energy required for compilation to be different from the current understanding (e.g., Fig. 2 – a state diagram describing the generation of an application profile; [0029] – the execution of each operation in the application increments a counter associated with the particular operation.; each executed operation is counted until an off command is received; a save results command causes the values of the counters to be stored in file; Fig. 3a – a state diagram describing the generation timing information for a virtual machine profile; Fig. 3b – a state diagram describing the generation energy information for a virtual machine profile; [0045] – the energy consumption data could be based on resources used by the operation and the time of execution; maximum and minimum execution times associated with the operation are maintained as well; upon receiving the save results command, the average energy consumption is calculated for each operation and is stored in the JVM profile)

11. **As to claim 9** (Original) (incorporating the rejection in claim 1), Chauvel discloses the method wherein the generated object code comprises a plurality of native instructions, and the method further comprises

- monitoring execution of the generated object code for power level required to execute the native instructions (e.g., [0012] – performance for a specified portion of an application, where the specified portion can include all or part of the application, the executes on a target device via a virtual machine interface is estimated by acquiring an application profile that specifies a number of executions for a plurality of operations used in the specified portion of the application, acquiring a virtual machine profile that relates a performance characteristic to individual operations and generating an aggregate value for the performance characteristic based on the application profile and the virtual machine profile; [0013]); and
- updating power level requirements of selected ones of the native instructions if said monitoring observes power level requirements for the selected ones of the native instructions to be different from current understandings of the power level requirements of the selected ones of the native instructions (e.g., Fig. 2 – a state diagram describing the generation of an application profile; [0029] – the execution of each operation in the application increments a counter associated with the particular operation.; each executed operation is counted until an off command is received; a save results command causes the values of the counters to be stored in file; Fig. 3a – a state diagram describing the generation

timing information for a virtual machine profile; Fig. 3b – a state diagram describing the generation energy information for a virtual machine profile; [0045] – the energy consumption data could be based on resources used by the operation and the time of execution; maximum and minimum execution times associated with the operation are maintained as well; upon receiving the save results command, the average energy consumption is calculated for each operation and is stored in the JVM profile)

12. **As to claim 10** (Original) (incorporating the rejection in claim 1), Chauvel discloses the method wherein the generated object code comprises a plurality of native instructions, and the method further comprises

- monitoring execution of the generated object code for amount of energy required to execute the native instructions (e.g., [0012] – performance for a specified portion of an application, where the specified portion can include all or part of the application, the executes on a target device via a virtual machine interface is estimated by acquiring an application profile that specifies a number of executions for a plurality of operations used in the specified portion of the application, acquiring a virtual machine profile that relates a performance characteristic to individual operations and generating an aggregate value for the performance characteristic based on the application profile and the virtual machine profile; [0013]); and

- updating energy requirements of selected ones of the native instructions if said monitoring observes energy requirements for the selected ones of the native instructions to be different from current understandings of the energy requirements of the selected ones of the native instructions (e.g., Fig. 2 – a state diagram describing the generation of an application profile; [0029] – the execution of each operation in the application increments a counter associated with the particular operation.; each executed operation is counted until an off command is received; a save results command causes the values of the counters to be stored in file; Fig. 3a – a state diagram describing the generation timing information for a virtual machine profile; Fig. 3b – a state diagram describing the generation energy information for a virtual machine profile; [0045] – the energy consumption data could be based on resources used by the operation and the time of execution; maximum and minimum execution times associated with the operation are maintained as well; upon receiving the save results command, the average energy consumption is calculated for each operation and is stored in the JVM profile)

13. **As to claim 11** (Previously Presented), Chauvel discloses in an electronic device, a method of operation, comprising:

- receiving a plurality of non-native instructions (e.g., [0008], the JVM executes the byte-codes just as a processor executes machine code; however, the byte-codes

do not directly control the underlying hardware; instead, they are interpreted by the JVM);

- determining an initial number of times to interpretively execute the non-native instructions based at least in part on one or more of an expected power level required or an expected energy required to perform a compile (e.g., Fig. 3b, element 56 and 54; [0013] - ... By independently generating the application profile, based on the number of times operations are executed in the application, and the virtual machine profile, based on actual hardware response on the target device, an accurate estimation of a performance criteria, such as ... energy consumption, for the application can be provided ...; Abstract - ... indicate the time/energy consumed by each operation on a particular hardware platform ... can be used to generate time and/or energy estimates for the application);
- executing the non-native instructions for the initial number of times using an interpreter (e.g., [0012] – performance for a specified portion of an application, where the specified portion can include all or part of the application, the executes on a target device via a virtual machine interface is estimated by acquiring an application profile that specifies a number of executions for a plurality of operations used in the specified portion of the application, acquiring a virtual machine profile that relates a performance characteristic to individual operations and generating an aggregate value for the performance characteristic based on the application profile and the virtual machine profile; [0013]; [0036] – to calculate the application profile, the application is executed with a JVM, which is

instrumented to count each operation and calculate the profile. The JVM which is used to generate the profile is referred to as the 'profiling tool')

Further, Chauvel disclose the profiling techniques described herein could be adapted to take into account an interpreter-based execution and a JIT one (e.g., [0063]) and to acquire a virtual machine profile that relates power consumption to individual operations (e.g., Page 7, Left-Col., Lines 32-35), but does not explicitly disclose compiling the non-native instructions into object code after executing the received non-native instructions for said initial number of times using the interpreter.

However, in an analogous art of *Loading Object-Oriented Computer Program*, Renouf discloses compiling the non-native instructions into object code after executing the received non-native instructions for said initial number of times using the interpreter (e.g., Fig. 2, elements 213 – Virtual Processor Byte Code; 214 – Native Translator; 230 – Native Code; Fig. 4; [0072] - ... The VP tools are then translated by the individual client translators 424, 425 into native methods 483, 484 which are optimized for their respective processors ...; NOTE: Chauvel discloses a profiling system indicating the time/energy consumed by each operation on a particular hardware platform (e.g., Abstract))

Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made to combine the teachings of Renouf into the Chauvel's system to further provide compiling the non-native instructions into object code after executing the received non-native instructions for said initial number of times using the interpreter in the Chauvel's system.

The motivation is that it would further enhance the Chauvel's system by taking, advancing and/or incorporating the Renouf's system which offers significant advantages when applied to wireless client networks, each individual transmission is of a significantly shorter duration than with conventional systems in which the entire class file has to be downloaded as once suggested by Renouf (e.g., [0042])

14. **As to claim 13** (Previously Presented) (incorporating the rejection in claim 11), Chauvel discloses the method wherein the method further comprises:

- monitoring said compiling for a compilation requirement employed in determining the initial number of times the received non-native instructions are to be executed using the interpreter before compiling (e.g., [0012] – performance for a specified portion of an application, where the specified portion can include all or part of the application, the executes on a target device via a virtual machine interface is estimated by acquiring an application profile that specifies a number of executions for a plurality of operations used in the specified portion of the application, acquiring a virtual machine profile that relates a performance characteristic to individual operations and generating an aggregate value for the performance characteristic based on the application profile and the virtual machine profile; [0013]; [0036] – to calculate the application profile, the application is executed with a JVM, which is instrumented to count each operation and calculate the profile. The JVM which is used to generate the profile is referred to as the 'profiling tool'); and

- updating a current understanding of the compilation requirement if said monitoring observes the compilation requirement to be different from the current understanding (Fig. 2 – a state diagram describing the generation of an application profile; [0029] – the execution of each operation in the application increments a counter associated with the particular operation.; each executed operation is counted until an off command is received; a save results command causes the values of the counters to be stored in file; Fig. 3a – a state diagram describing the generation timing information for a virtual machine profile; Fig. 3b – a state diagram describing the generation energy information for a virtual machine profile; [0045] – the energy consumption data could be based on resources used by the operation and the time of execution; maximum and minimum execution times associated with the operation are maintained as well; upon receiving the save results command, the average energy consumption is calculated for each operation and is stored in the JVM profile)

15. **As to claim 14** (Original) (incorporating the rejection in claim 11), Chauvel discloses the method wherein the generated object code comprises a plurality of native instructions, and the method further comprises

- monitoring execution of the generated object code for execution requirements of the native instructions (e.g., [0012] – performance for a specified portion of an application, where the specified portion can include all or part of the application, the executes on a target device via a virtual machine interface is estimated by

- acquiring an application profile that specifies a number of executions for a plurality of operations used in the specified portion of the application, acquiring a virtual machine profile that relates a performance characteristic to individual operations and generating an aggregate value for the performance characteristic based on the application profile and the virtual machine profile; [0013]); and
- updating execution requirements of selected ones of the native instructions if said monitoring observes execution requirements for the selected ones of the native instructions to be different from current understandings of the execution requirements of the selected ones of the native instructions (e.g., Fig. 2 – a state diagram describing the generation of an application profile; [0029] – the execution of each operation in the application increments a counter associated with the particular operation.; each executed operation is counted until an off command is received; a save results command causes the values of the counters to be stored in file; Fig. 3a – a state diagram describing the generation timing information for a virtual machine profile; Fig. 3b – a state diagram describing the generation energy information for a virtual machine profile; [0045] – the energy consumption data could be based on resources used by the operation and the time of execution; maximum and minimum execution times associated with the operation are maintained as well; upon receiving the save results command, the average energy consumption is calculated for each operation and is stored in the JVM profile)

16. **As to claim 15** (Previously Presented), Chauvel discloses an article of manufacture comprising:

- a computer readable medium (e.g., Fig. 1b – element of 16 – HW Platform; [0025], Lines 1-2, 5-11 – a JVM profile is generated for a specific hardware platform)

Further, Chauvel disclose the profiling techniques described herein could be adapted to take into account an interpreter-based execution and a JIT one (e.g., [0063]) and to acquire a virtual machine profile that relates power consumption to individual operations (e.g., Page 7, Left-Col., Lines 32-35), but does not explicitly disclose a plurality of instructions designed to implement a compiler to compile non-native instructions to generate object code for the non-native instructions, and replace an object code segment with an alternative object code segment if the alternative object code segment improves at least a selected one of a power level required and an energy required to execute the generated object code.

However, in an analogous art of *Loading Object-Oriented Computer Program*, Renouf discloses a plurality of instructions designed to implement a compiler to compile non-native instructions to generate object code for the non-native instructions (e.g., Fig. 2, elements 213 – Virtual Processor Byte Code; 214 – Native Translator; 230 – Native Code), and replace an object code segment with an alternative object code segment (e.g., [0123] - ... On binding (or sometimes at run-time) the fix-up code will be replaced with appropriate machine-dependent instructions ... converted to an atom in the native code) if the alternative object code segment improves at least a selected one of a

power level required and an energy required to execute the generated object code (e.g., Fig. 4; [0072] - ... The VP tools are then translated by the individual client translators 424, 425 into native methods 483, 484 which are optimized for their respective processors ...; NOTE: Chauvel discloses a profiling system indicating the time/energy consumed by each operation on a particular hardware platform (e.g., Abstract))

Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made to combine the teachings of Renouf into the Chauvel's system to further provide a plurality of instructions designed to implement a compiler to compile non-native instructions to generate object code for the non-native instructions, and replace an object code segment with an alternative object code segment if the alternative object code segment improves at least a selected one of a power level required and an energy required to execute the generated object code in the Chauvel's system.

The motivation is that it would further enhance the Chauvel's system by taking, advancing and/or incorporating the Renouf's system which offers significant advantages when applied to wireless client networks, each individual transmission is of a significantly shorter duration than with conventional systems in which the entire class file has to be downloaded as once suggested by Renouf (e.g., [0042])

17. **As to claim 16** (Previously Presented) (incorporating the rejection in claim 15), please refer to claim 3 as set forth accordingly

18. **As to claim 17** (Previously Presented) (incorporating the rejection in claim 15), please refer to claim 4 as set forth accordingly.

19. **As to claim 18** (Currently Amended), Chauvel discloses an article of manufacture comprising:

- a computer readable medium (e.g., Fig. 1b – element of 16 – HW Platform; [0025], Lines 1-2, 5-11 – a JVM profile is generated for a specific hardware platform)
- determining an initial number of times to interpretively execute the non-native instructions based at least in part on one or more of an expected power level required or an expected energy required to perform an average compile (e.g., Fig. 3b, element 56 and 54; [0013] - ... By independently generating the application profile, based on the number of times operations are executed in the application, and the virtual machine profile, based on actual hardware response on the target device, an accurate estimation of a performance criteria, such as ... energy consumption, for the application can be provided ...; Abstract - ... indicate the time/energy consumed by each operation on a particular hardware platform ... can be used to generate time and/or energy estimates for the application)

Further, Chauvel discloses the profiling techniques described herein could be adapted to take into account an interpreter-based execution and a JIT one (e.g., [0063]) and to acquire a virtual machine profile that relates power consumption to individual operations (e.g., Page 7, Left-Col., Lines 32-35), but does not explicitly disclose a

plurality of instructions designed to implement a runtime manager equipped to receive a plurality of non-native instructions, execute the non-native instructions for an initial number of times using an interpreter, and invoke a compiler to compile the non-native instructions into object code after executing the received non-native instructions for said initial number of times using the interpreter.

However, in an analogous art of *Loading Object-Oriented Computer Program*, Renouf discloses a plurality of instructions designed to implement a runtime manager equipped to receive a plurality of non-native instructions, execute the non-native instructions for an initial number of times using an interpreter, and invoke a compiler to compile the non-native instructions into object code after executing the received non-native instructions for said initial number of times using the interpreter (e.g., , Fig. 2, elements 213 – Virtual Processor Byte Code; 214 – Native Translator; 230 – Native Code; Fig. 4; [0072] - ... The VP tools are then translated by the individual client translators 424, 425 into native methods 483, 484 which are optimized for their respective processors ...; NOTE: Chauvel discloses a profiling system indicating the time/energy consumed by each operation on a particular hardware platform (e.g., Abstract))

Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made to combine the teachings of Renouf into the Chauvel's system to further provide a plurality of instructions designed to implement a runtime manager equipped to receive a plurality of non-native instructions, execute the non-native instructions for an initial number of times using an interpreter, and invoke a compiler to

compile the non-native instructions into object code after executing the received non-native instructions for said initial number of times using the interpreter in the Chauvel's system.

The motivation is that it would further enhance the Chauvel's system by taking, advancing and/or incorporating the Renouf's system which offers significant advantages when applied to wireless client networks, each individual transmission is of a significantly shorter duration than with conventional systems in which the entire class file has to be downloaded as once suggested by Renouf (e.g., [0042])

20. **As to claim 20** (Original) (incorporating the rejection in claim 18), Chauvel discloses the article wherein the runtime manager is further equipped to

- monitor said compiling for a compilation requirement employed in determining the initial number of times received non-native instructions are to be executed before compiling (e.g.,); and
- update a current understanding of the compilation requirement if said monitoring observes the compilation requirement to be different from the current understanding (e.g., Fig. 2 – a state diagram describing the generation of an application profile; [0029] – the execution of each operation in the application increments a counter associated with the particular operation.; each executed operation is counted until an off command is received; a save results command causes the values of the counters to be stored in file; Fig. 3a – a state diagram describing the generation timing information for a virtual machine profile; Fig. 3b

– a state diagram describing the generation energy information for a virtual machine profile; [0045] – the energy consumption data could be based on resources used by the operation and the time of execution; maximum and minimum execution times associated with the operation are maintained as well; upon receiving the save results command, the average energy consumption is calculated for each operation and is stored in the JVM profile)

21. **As to claim 21** (Original) (incorporating the rejection in claim 18), Chauvel discloses the article wherein the generated object code comprises a plurality of native instructions, and the runtime manager is further equipped to

- monitor execution of the generated object code for execution requirements of the native instructions (e.g., [0012] – performance for a specified portion of an application, where the specified portion can include all or part of the application, the executes on a target device via a virtual machine interface is estimated by acquiring an application profile that specifies a number of executions for a plurality of operations used in the specified portion of the application, acquiring a virtual machine profile that relates a performance characteristic to individual operations and generating an aggregate value for the performance characteristic based on the application profile and the virtual machine profile; [0013]); and
- update execution requirements of selected ones of the native instructions if said monitoring observes execution requirements for the selected ones of the native instructions to be different from current understandings of the execution

requirements of the selected ones of the native instructions (e.g., Fig. 2 – a state diagram describing the generation of an application profile; [0029] – the execution of each operation in the application increments a counter associated with the particular operation.; each executed operation is counted until an off command is received; a save results command causes the values of the counters to be stored in file; Fig. 3a – a state diagram describing the generation timing information for a virtual machine profile; Fig. 3b – a state diagram describing the generation energy information for a virtual machine profile; [0045] – the energy consumption data could be based on resources used by the operation and the time of execution; maximum and minimum execution times associated with the operation are maintained as well; upon receiving the save results command, the average energy consumption is calculated for each operation and is stored in the JVM profile)

22. **As to claim 22** (Previously Presented), Chauvel discloses a system, comprising:
- a storage medium having stored therein a plurality of instructions implementing a compiler to compile non-native instructions to generate object code for the non-native instructions, and replace an object code segment with an alternative object code segment if the alternative object code segment improves at least a selected one of a power level required and an energy required to execute the generated object code; and

- a processor coupled to the storage medium to execute the instructions implementing the compiler (e.g., Abstract – creating application profiles that indicate the number of execution of each operation in the application and virtual machine profiles which indicate the time/energy consumed by each operation on a particular hardware platform; an application profile in conjunction with the virtual machine profile can be used to generate time and/or energy estimates for the application; [0062] – to adapt the JVM profile in order to obtain energy consumption estimations of a JAVA™ application; instead of (or in addition to) profiling the execution time on the target, the estimation of energy consumption could be performed using the same principle as for execution; the energy performance (and execution time performance) could be used by the target device for scheduling applications; [0066], Lines 32-35 – acquiring a virtual machine profile that relates power consumption to individual operations; [0010] – to optimize an application, estimations of execution time or energy consumption are often needed; this is particular true in the case of mobile devices, such as smart phones, personal digital assistants, and the like, which have limit energy and processing resources)

Further, Chauvel discloses the profiling techniques described herein could be adapted to take into account an interpreter-based execution and a JIT one (e.g., [0063]) and to acquire a virtual machine profile that relates power consumption to individual operations (e.g., Page 7, Left-Col., Lines 32-35), but does not explicitly disclose a

storage medium having stored therein a plurality of instructions implementing a compiler to compile non-native instructions to generate object code for the non-native instructions, and replace an object code segment with an alternative object code segment if the alternative object code segment improves at least a selected one of a power level required and an energy required to execute the generated object code.

However, in an analogous art of *Loading Object-Oriented Computer Program*, Renouf discloses a storage medium having stored therein a plurality of instructions implementing a compiler to compile non-native instructions to generate object code for the non-native instructions (e.g., Fig. 2, elements 213 – Virtual Processor Byte Code; 214 – Native Translator; 230 – Native Code)

Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made to combine the teachings of Renouf into the Chauvel's system to further provide a storage medium having stored therein a plurality of instructions implementing a compiler to compile non-native instructions to generate object code for the non-native instructions, and replace an object code segment with an alternative object code segment if the alternative object code segment improves at least a selected one of a power level required and an energy required to execute the generated object code in Chauvel's system.

The motivation is that it would further enhance the Chauvel's system by taking, advancing and/or incorporating the Renouf's system which offers significant advantages when applied to wireless client networks, each individual transmission is of a

significantly shorter duration than with conventional systems in which the entire class file has to be downloaded as once suggested by Renouf (e.g., [0042])

23. **As to claim 23** (Previously Presented) (incorporating the rejection in claim 22), Chauvel discloses the system wherein said compiler analyzes the object code segment for execution power level requirement, and determining whether an alternative object code segment with lower execution power level requirement is available (e.g., Abstract – creating application profiles that indicate the number of execution of each operation in the application and virtual machine profiles which indicate the time/energy consumed by each operation on a particular hardware platform; an application profile in conjunction with the virtual machine profile can be used to generate time and/or energy estimates for the application; [0062] – to adapt the JVM profile in order to obtain energy consumption estimations of a JAVA™ application; instead of (or in addition to) profiling the execution time on the target, the estimation of energy consumption could be performed using the same principle as for execution; the energy performance (and execution time performance) could be used by the target device for scheduling applications; [0066], Lines 32-35 – acquiring a virtual machine profile that relates power consumption to individual operations; [0010] – to optimize an application, estimations of execution time or energy consumption are often needed; this is particular true in the case of mobile devices, such as smart phones, personal digital assistants, and the like, which have limit energy and processing resources)

24. **As to claim 24** (Previously Presented) (incorporating the rejection in claim 22), Chauvel discloses the system wherein said compiler analyzes the object code segment for execution energy consumption, and determining whether an alternative object code segment with lower execution energy consumption is available (e.g., Abstract – creating application profiles that indicate the number of execution of each operation in the application and virtual machine profiles which indicate the time/energy consumed by each operation on a particular hardware platform; an application profile in conjunction with the virtual machine profile can be used to generate time and/or energy estimates for the application; [0062] – to adapt the JVM profile in order to obtain energy consumption estimations of a JAVA™ application; instead of (or in addition to) profiling the execution time on the target, the estimation of energy consumption could be performed using the same principle as for execution; the energy performance (and execution time performance) could be used by the target device for scheduling applications; [0066], Lines 32-35 – acquiring a virtual machine profile that relates power consumption to individual operations; [0010] – to optimize an application, estimations of execution time or energy consumption are often needed; this is particular true in the case of mobile devices, such as smart phones, personal digital assistants, and the like, which have limit energy and processing resources)

25. **As to claim 25** (Original) (incorporating the rejection in claim 22), Chauvel discloses the system wherein the apparatus further comprises a wireless communication interface to receive the non-native instructions (e.g., [0010], Lines 1-3 –

to optimize an application, estimations of execution time or energy consumption are often needed; this is particularly true in the case of mobile devices...; [0061], Lines 1-7 – can be downloaded through a network)

26. **As to claim 26** (Currently Amended), Chauvel discloses a system, comprising:

- a communication interface to receive a plurality of non-native instructions (e.g., [0010], Lines 1-3 – to optimize an application, estimations of execution time or energy consumption are often needed; this is particularly true in the case of mobile devices...; [0061], Lines 1-7 – can be downloaded through a network);
- a processor coupled to the storage medium to execute the instructions implementing the runtime manager (e.g., [0008])
- determining an initial number of times to interpretively execute the non-native instructions based at least in part on one or more of an expected power level required or an expected energy required to perform an average compile (e.g., Fig. 3b, element 56 and 54; [0013] - ... By independently generating the application profile, based on the number of times operations are executed in the application, and the virtual machine profile, based on actual hardware response on the target device, an accurate estimation of a performance criteria, such as ... energy consumption, for the application can be provided ...; Abstract - ... indicate the time/energy consumed by each operation on a

particular hardware platform ... can be used to generate time and/or energy estimates for the application)

Further, Chauvel discloses the profiling techniques described herein could be adapted to take into account an interpreter-based execution and a JIT one (e.g., [0063]) and to acquire a virtual machine profile that relates power consumption to individual operations (e.g., Page 7, Left-Col., Lines 32-35), but does not explicitly disclose a storage medium coupled to the communication interface, and having stored therein a plurality of instructions designed to implement a runtime manager equipped to execute the received non-native instructions for an initial number of times using an interpreter, and invoke a compiler to compile the non-native instructions into object code after executing the received non-native instructions for said initial number of times using the interpreter.

However, in an analogous art of *Loading Object-Oriented Computer Program*, Renouf discloses a storage medium coupled to the communication interface, and having stored therein a plurality of instructions designed to implement a runtime manager equipped to execute the received non-native instructions for an initial number of times using an interpreter, and invoke a compiler to compile the non-native instructions into object code after executing the received non-native instructions for said initial number of times using the interpreter (e.g., Fig. 2, elements 213 – Virtual Processor Byte Code; 214 – Native Translator; 230 – Native Code; Fig. 4; [0072] - ... The VP tools are then translated by the individual client translators 424, 425 into native methods 483, 484 which are optimized for their respective processors ...; NOTE:

Chauvel discloses a profiling system indicating the time/energy consumed by each operation on a particular hardware platform (e.g., Abstract))

Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made to combine the teachings of Renouf into the Chauvel's system to further provide a storage medium coupled to the communication interface, and having stored therein a plurality of instructions designed to implement a runtime manager equipped to execute the received non-native instructions for an initial number of times using an interpreter, and invoke a compiler to compile the non-native instructions into object code after executing the received non-native instructions for said initial number of times using the interpreter in the Chauvel's system.

The motivation is that it would further enhance the Chauvel's system by taking, advancing and/or incorporating the Renouf's system which offers significant advantages when applied to wireless client networks, each individual transmission is of a significantly shorter duration than with conventional systems in which the entire class file has to be downloaded as once suggested by Renouf (e.g., [0042])

27. **As to claim 28** (Previously Presented) (incorporating the rejection in claim 26),

Chauvel discloses the system wherein the runtime manager is further equipped to

- monitor said compiling for a compilation requirement employed in determining the initial number of times received non-native instructions are to be executed using the interpreter before compiling (e.g., [0012] – performance for a specified portion of an application, where the specified portion can include all or part of the

application, the executes on a target device via a virtual machine interface is estimated by acquiring an application profile that specifies a number of executions for a plurality of operations used in the specified portion of the application, acquiring a virtual machine profile that relates a performance characteristic to individual operations and generating an aggregate value for the performance characteristic based on the application profile and the virtual machine profile; [0013]; [0036] – to calculate the application profile, the application is executed with a JVM, which is instrumented to count each operation and calculate the profile. The JVM which is used to generate the profile is referred to as the 'profiling tool'); and

- update a current understanding of the compilation requirement if said monitoring observes the compilation requirement to be different from the current understanding (e.g., Fig. 2 – a state diagram describing the generation of an application profile; [0029] – the execution of each operation in the application increments a counter associated with the particular operation.; each executed operation is counted until an off command is received; a save results command causes the values of the counters to be stored in file; Fig. 3a – a state diagram describing the generation timing information for a virtual machine profile; Fig. 3b – a state diagram describing the generation energy information for a virtual machine profile; [0045] – the energy consumption data could be based on resources used by the operation and the time of execution; maximum and minimum execution times associated with the operation are maintained as well;

upon receiving the save results command, the average energy consumption is calculated for each operation and is stored in the JVM profile)

28. **As to claim 29** (Original) (incorporating the rejection in claim 26), Chauvel discloses the system wherein the generated object code comprises a plurality of native instructions, and the runtime manager is further equipped to

- monitor execution of the generated object code for execution requirements of the native instructions (e.g., [0012] – performance for a specified portion of an application, where the specified portion can include all or part of the application, the executes on a target device via a virtual machine interface is estimated by acquiring an application profile that specifies a number of executions for a plurality of operations used in the specified portion of the application, acquiring a virtual machine profile that relates a performance characteristic to individual operations and generating an aggregate value for the performance characteristic based on the application profile and the virtual machine profile; [0013]); and
- update execution requirements of selected ones of the native instructions if said monitoring observes execution requirements for the selected ones of the native instructions to be different from current understandings of the execution requirements of the selected ones of the native instructions (e.g., Fig. 2 – a state diagram describing the generation of an application profile; [0029] – the execution of each operation in the application increments a counter associated with the particular operation.; each executed operation is counted until an off

command is received; a save results command causes the values of the counters to be stored in file; Fig. 3a – a state diagram describing the generation timing information for a virtual machine profile; Fig. 3b – a state diagram describing the generation energy information for a virtual machine profile; [0045] – the energy consumption data could be based on resources used by the operation and the time of execution; maximum and minimum execution times associated with the operation are maintained as well; upon receiving the save results command, the average energy consumption is calculated for each operation and is stored in the JVM profile)

29. **As to claim 30** (Original) (incorporating the rejection in claim 26), Chauvel discloses the system wherein the communication interface is a wireless communication interface (e.g., [0010], Lines 1-3 – to optimize an application, estimations of execution time or energy consumption are often needed; this is particularly true in the case of mobile devices ...; [0061], Lines 1-7 – can be downloaded through a network)

30. **As to claim 31** (New) (incorporating the rejection in claim 11), Chauvel discloses the method wherein the method further comprises determining an initial number of times to interpretively execute the non-native instructions based at least in part on a size of the non-native instructions (e.g., [0012] - ... by acquiring an application profile that specifies a number of executions for a plurality of operations used in the specified portion of the application ... acquiring a virtual machine profile that relates a

performance characteristic to individual operations and generating an aggregate value for the performance characteristic based on the application profile and the virtual machine profile)

31. **As to claim 31** (New) (incorporating the rejection in claim 18), please refer to claim **31** above, accordingly.

32. **As to claim 31** (New) (incorporating the rejection in claim 26), please refer to claim **31** above, accordingly.

Conclusion

33. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ben C. Wang whose telephone number is 571-270-1240. The examiner can normally be reached on Monday - Friday, 8:00 a.m. - 5:00 p.m., EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tuan Q. Dam can be reached on 571-272-3695. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ben C Wang/
Examiner, Art Unit 2192

/Tuan Q. Dam/
Supervisory Patent Examiner, Art Unit 2192